

Department of Defense
Climate-Related Risk to DoD Infrastructure
Initial Vulnerability Assessment Survey
(SLVAS) Report



January 2018

Office of the Under Secretary of Defense
for Acquisition, Technology, and Logistics

As required by Senate Report 114-237, page 11 (TAB C), accompanying S. 2806 of the Military Construction, Veterans Affairs and Related Agencies Appropriations Bill for Fiscal Year 2017.

The estimated cost of this report or study for the Department of Defense is approximately \$105,000 in Fiscal Years 2015-2017. This includes \$65,000 in expenses and \$40,000 in DoD labor.
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EXECUTIVE SUMMARY

Background. Senate Report 114-67 accompanying the fiscal year 2016 Military Construction, Veterans Affairs and Related Agencies appropriations bill included language directing the DoD to include an assessment of coastal erosion and potential flooding risks in the siting of proposed military construction projects. In a July 23, 2015, report to Congress regarding the security implications of climate-related risks, the Department noted that it has directed a global screening level assessment to determine installation vulnerabilities to climate-related security risks with the goal of identifying serious vulnerabilities and developing necessary adaptation strategies. The Committee directed the Secretary of Defense to report to the congressional defense committees not later than 120 days after enactment of this act, describing the results or the status of the vulnerability assessment, the adaptation strategies developed for vulnerable installations, and the estimated costs associated with implementing these strategies.

The Department of Defense (DoD) has significant experience in planning for and managing risk and uncertainty. The effects of climate and extreme weather represent additional risks to incorporate into the Department's various planning and risk management processes. Various studies have identified a broad range of effects that could impact our ability to fully execute the Defense mission of protecting and maintaining the security interests of the United States at home and around the world.

Survey Process. To identify DoD installations with vulnerabilities, the Office of the Assistant Secretary of Defense for Energy, Installations and Environment [OASD(EI&E)], initiated a preliminary Screening Level Vulnerability Assessment Survey (SLVAS) of DoD sites worldwide.

The web-based survey was developed in concert with the Military Services, Defense Logistics Agency and Washington Headquarters Services, as the infrastructure owning/managing components. Qualitative survey questions were framed to begin to identify sites with current weather-related effects and where more comprehensive assessment may be needed in order to identify potential effects of extreme weather. The survey questions focused on observed effects from past severe weather events (which may be indicative of more frequent and/or more severe future conditions), and the proximity of site acreage to any flood-prone areas. The survey asked respondents to identify any negative effects they may have experienced from extreme weather effects, both on the assets on the DoD site itself as well as any observed effects on similar assets in the surrounding community that provided supporting services (e.g., utilities, transportation, emergency response) for the DoD site. These included:

- Flooding due to storm surge
- Flooding due to non-storm surge events (e.g., rain, snow, sleet, ice, river overflow)
- Extreme temperatures (both hot and cold)
- Wind
- Drought
- Wildfire

The asset categories evaluated included:

- | | |
|---|---|
| - Airfield Operations (on and off-site) | - Training Areas/Ranges (on-site) |
| - Piers/Waterfront Services (on and off-site) | - Personnel Support (on-site) |
| - Command, Control, Communications, Computers, Intelligence, Surveillance and | - HQ Buildings (on-site) |
| | - Information Systems (on and off-site) |

- | | |
|---|---|
| Reconnaissance or C4ISR (on-site) | - Energy Infrastructure (on and off-site) |
| - Fuel Infrastructure (on and off-site) | - Logistics/supply (on and off-site) |
| - Transportation Infrastructure (on and off-site) | - Emergency Services (on and off-site) |
| - Water/Wastewater Systems (on and off-site) | - HVAC Systems (on and off-site) |
| - Environmental Restoration sites (on-site) | - Natural Resources (on-site) |
| - Historic/Cultural Resources (on-site) | - Housing (on and off-site) |

The survey included the option to indicate that no assets had ever been negatively affected, the inability to determine if any assets had been affected, or a narrative block to describe other assets not included in the above list that had been negatively affected. The SLVAS questionnaire is provided in Appendix 1.

The SLVAS was completed for all primary installations and associated sites worldwide (over 3,500 individual sites) in the initial year that ended September 2015. Sites were identified based on the DoD Real Property Database and do not include U.S. Army Corps of Engineer (USACE) Civil Works sites as they fall under different oversight authorities.

Analysis, Trends and Conclusions. The SLVAS responses yielded a wide range of qualitative information. The highest number of reported effects resulted from drought (782) followed closely by wind (763) and non-storm surge related flooding (706). About 10% of sites indicated being affected by extreme temperatures (351), while flooding due to storm surge (225) and wildfire (210) affected about 6% of the sites reporting. Nearly 50% of sites (1,684) reported they had no effects to any assets from the effects. The geographic dispersion of sites reporting negative effects from one or more effects was very broad and was very similar to those reporting no effects at all. This may have more to do with the nature of a qualitative survey completed by hundreds of different users than it did the actual sites themselves.

The asset categories most reported as having one or more effects in the past were: airfield operations, followed by transportation infrastructure, energy infrastructure, training/range facilities, and water/wastewater systems to round out the top five. Logistics/supply operations ranked last in reported effects.

The survey responses provide a preliminary qualitative picture of assets currently affected by severe weather events (e.g., storm surge, wildfires, high winds) as well as an indication of assets that may be affected by sea level rise in the future.

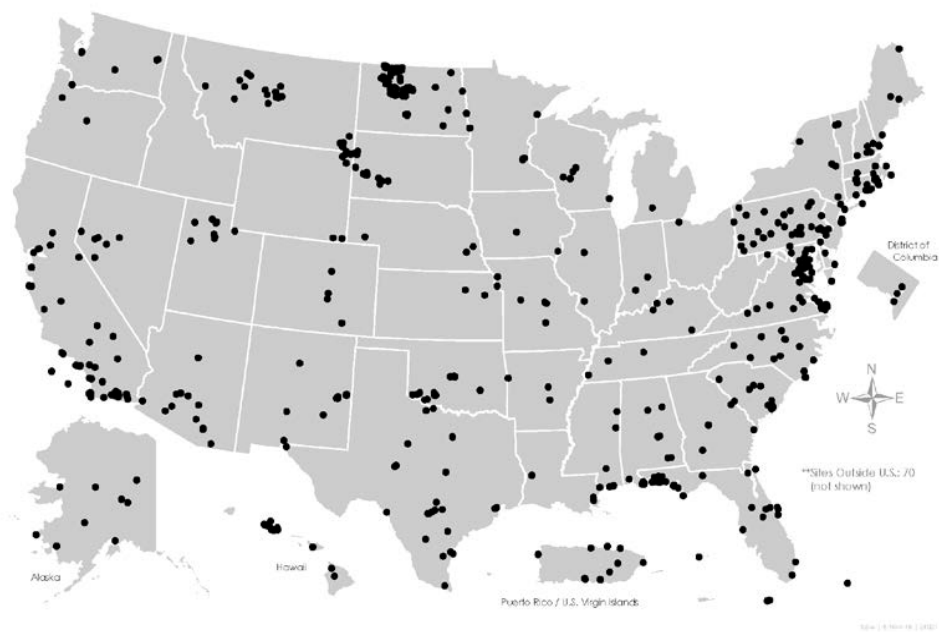
The maps below provide results for U.S. sites only. The nine maps contain dots for each site that has indicated effects from:

- Map 1 – flooding from storm surge
- Map 2 – flooding from non-storm surge events
- Map 3 – extreme temperatures
- Map 4 – drought
- Map 5 – wildfire
- Map 6 – wind
- Map 7 – two or more factors
- Map 8 – no factors

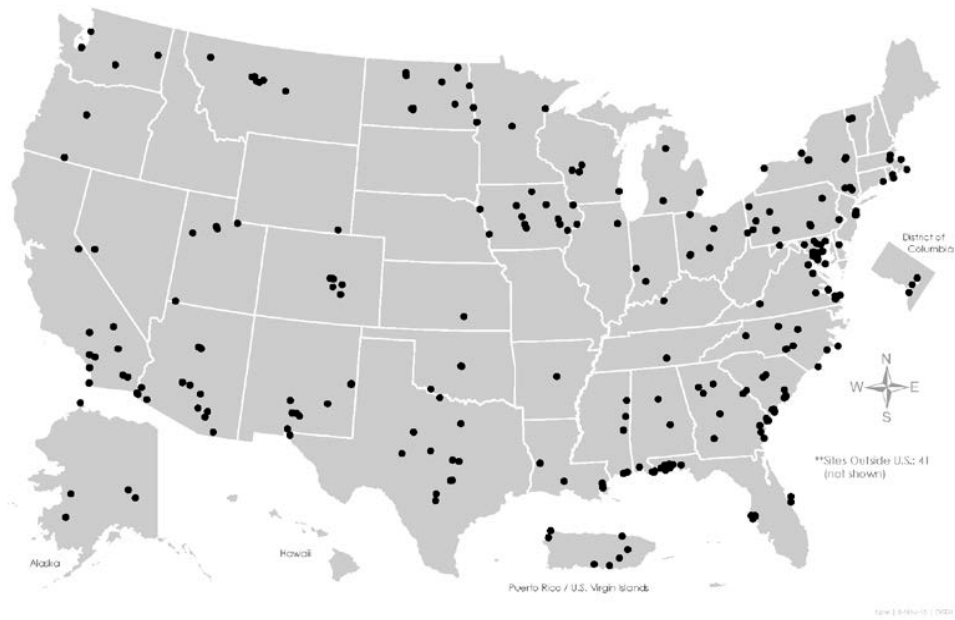
Map 1 - Sites that Indicated Flooding Effects from Storm Surge



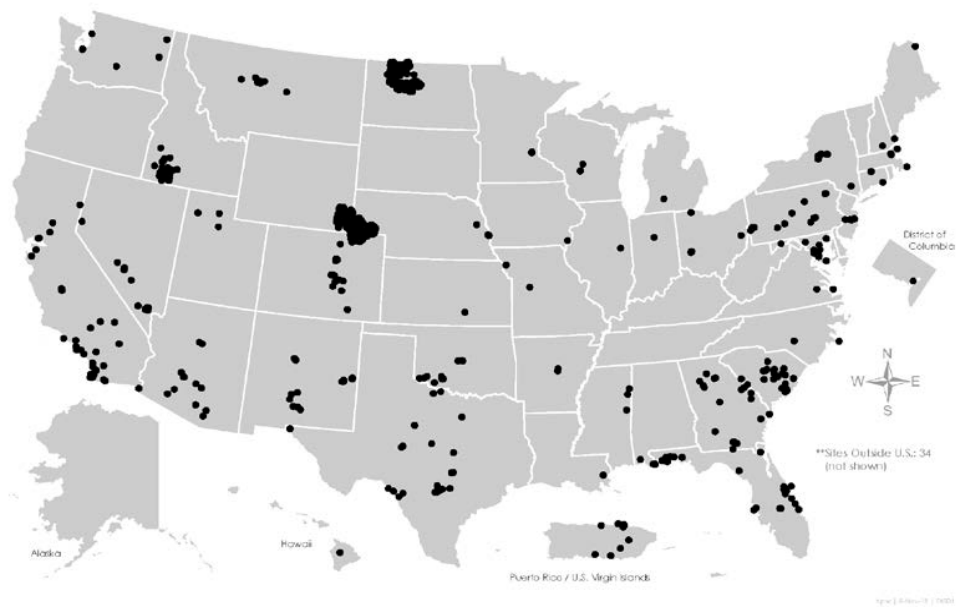
Map 2 – Sites that Indicated Flooding Effects from Non-Storm Surge Events (e.g., Rain, Snow, Sleet, Ice, River Overflow)



Map 3 - Sites that Indicated Effects from Extreme Temperatures (Hot and Cold)

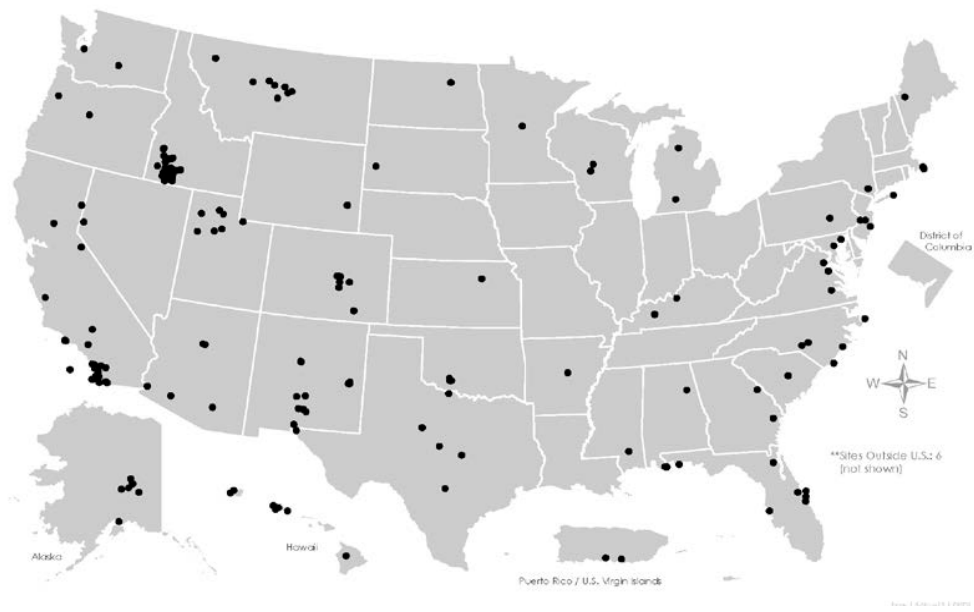


Map 4 - Sites that Indicated Effects from Drought

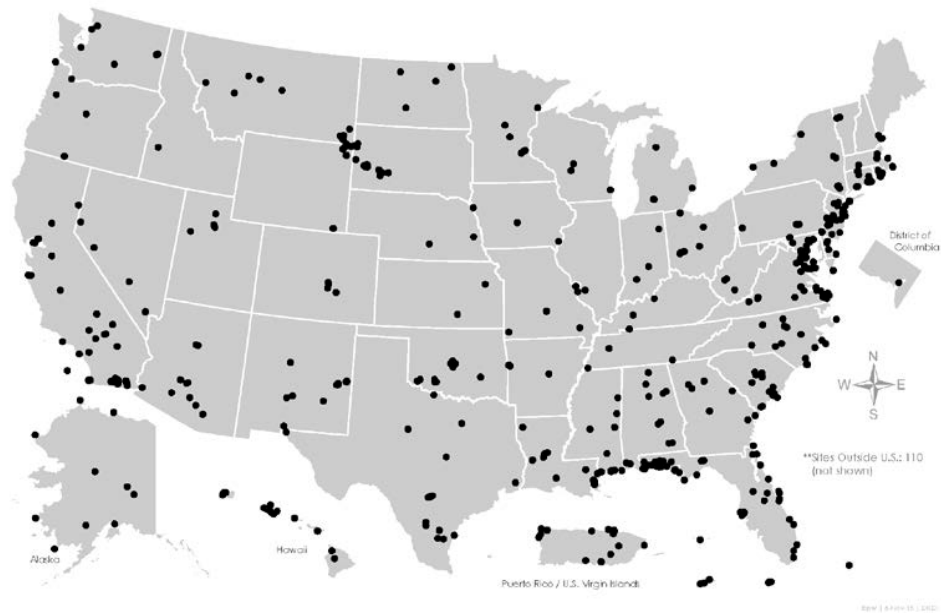


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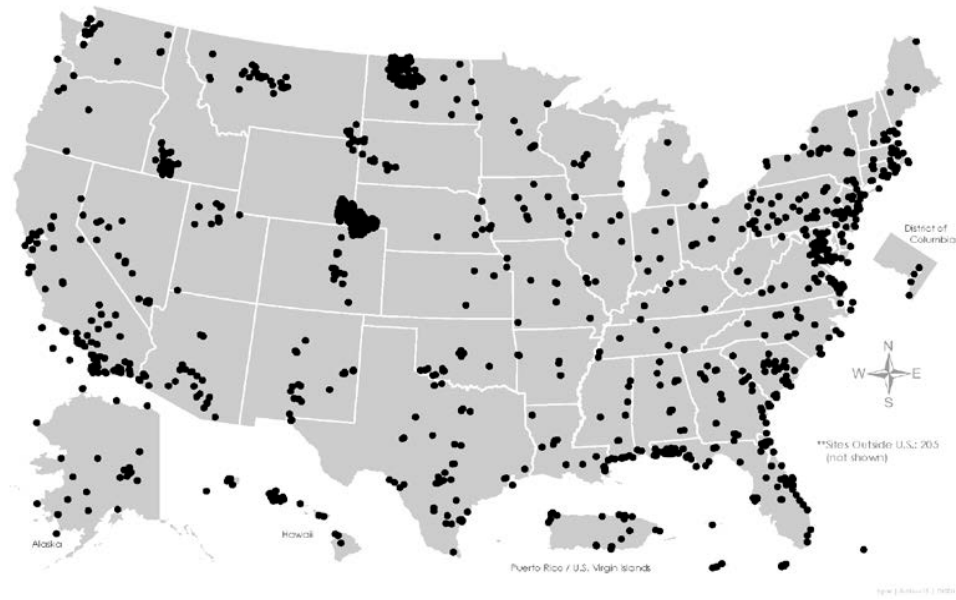
Map 5 - Sites that Indicated Effects from Wildfire



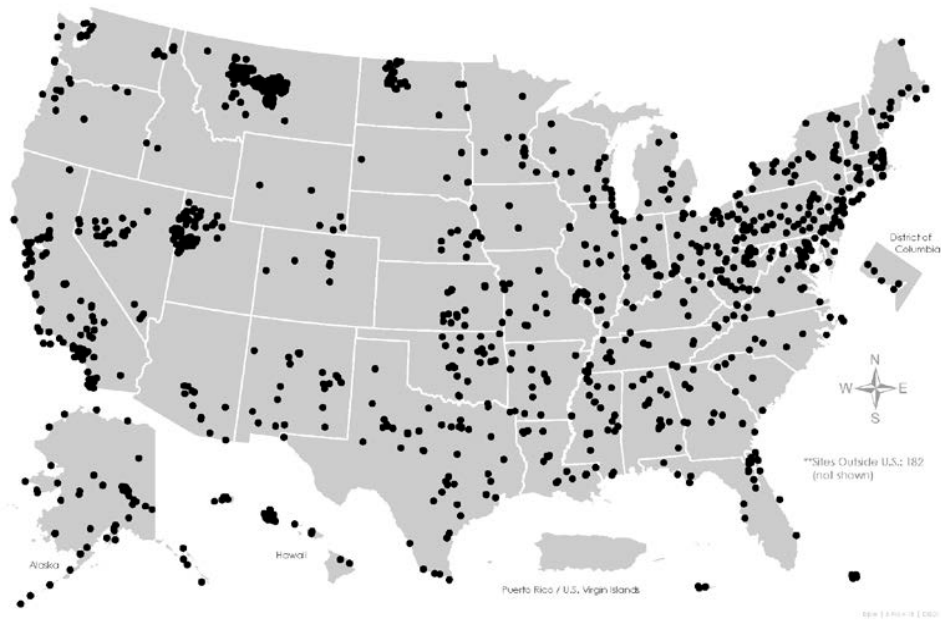
Map 6 - Sites that Indicated Effects from Wind



Map 7 - Sites that Indicated Effects from Multiple Vulnerability Areas (Flooding, Extreme Temperatures, Wind, Drought, Wildfire)



Map 8 - Sites that Indicated No Effects from Previous Events in the Vulnerability Areas



A CHANGING CLIMATE, NATIONAL SECURITY AND DoD – WHY DO WE CARE?

The nature of our mission. DoD looks at climate through the lens of its mission. From that perspective, changes in climate affect national security in several ways. Changes in climate can potentially shape the environment in which we operate and the missions we are required to do.

The safety and suitability of our infrastructure. Our warfighters require bases from which to deploy, on which to train, or to live when they are not deployed. If extreme weather makes our critical facilities unusable or necessitate costly or manpower-intensive work-arounds, that is an unacceptable impact. Beginning in 2014, DoD began the three-phased screening-level survey approach (pilot sites, coastal/tidal, remaining enduring sites) that is the subject of this report. A summary of the screening-level survey development and application are provided in the next section of the report.

The SLVAS was developed to take an initial look at where our assets have been affected from climate. Because the information collected from these surveys is highly qualitative, it is best used as an initial indicator of where a more in-depth assessment may be warranted. The SLVAS is the first step in an on-going process to manage the risks associated with climate to the DoD mission, installations, and ranges.

Examples of extreme weather events and their effects follow.

Army

Fort Irwin, CA

In August 2013, a late summer monsoon rain storm struck Fort Irwin. This storm brought several inches of rain in a short period of time. Storm water flowed into the main cantonment area from the mountains around the post causing great damage to property. More than 160 buildings in the cantonment area were flooded and sections of Fort Irwin's extensive training area also sustained major storm damage. Training structures were toppled and supporting electronic target and communications systems were damaged.

Weeks of effort were required to clean storm debris from the cantonment area's roads and parking lots. Soldiers, Civilians, and contractors all pitched in clear debris from roads and buildings, and. Many buildings were closed for repair for months.

West Point Military Reservation, NY

While less than 5 percent of the West Point Military Reservation is within 0-3 feet of mean sea level, that portion of the installation includes transportation and wastewater treatment infrastructure. Due to its physical/geographic location, flooding has occurred at West Point numerous times in the past 30 years. During Superstorm Sandy, some sections of the installation reported significant inundation.

Wind Damage at Multiple Installations

Multiple Army installations, from coastal (e.g., Military Ocean Terminal Concord) to inland locations (e.g., Oklahoma National Guard), reported impacts from high winds. The most common impacts from wind-related events included damage to above-ground electric/power infrastructure (especially power lines) and to roofs of buildings.



Photos of flooding in the training area at Fort Irwin, CA in August 2013 (US Army Photo)



Flooding in the cantonment area at Fort Irwin, CA in August 2013 (US Army Photo)

Navy

U.S. Naval Academy, Annapolis, MD

Due to impacts from weather events like Hurricane Isabel and storm surge, the U.S. Naval Academy (USNA) in Annapolis was one of the first installations to be analyzed for vulnerabilities to climate change, focusing on the importance of infrastructure utilities including water, power, heating, and cooling. This analysis demonstrated the high dependence of building systems on utilities and transportation networks.



USNA academic buildings and athletic fields in aftermath of Hurricane Isabel
(http://www.naany.org/Hurricane_Isabel_strikes_USNA_2.htm)



USNA flood damage due to storm surge
(<http://icons.wunderground.com/data/wximagenew/awalex/0.jpg>)

Naval Weapons Station Earle, NJ

On October 29, 2012, Hurricane Sandy struck the east coast of the United States as the second costliest hurricane in U.S. history, resulting in \$71B in damage. Naval Weapons Station Earle was subject to high winds, storm surge and intense precipitation, resulting in \$24 million in damages to their 2.9 mile long pier complex. Nearly eight miles of water and sewer piping were destroyed at the base and particularly along the pier.



([U.S. Navy Photo](#))

Air Force

Cape Lisburne Seawall Replacement



(U.S. Air Force photo)

Arctic sea ice is in constant change, growing in the fall and winter and receding in the spring and summer. The proximity of Air Force long range radar on the North Slope of Alaska to the Arctic shoreline makes them vulnerable to accelerated shoreline erosion from the duration and extent of sea ice fluctuations, increasing water temperatures, thawing of permafrost soils, and the effects of wave action.

The rock seawall at the Cape Lisburne Long Range Radar Station on the northwest Alaska coast line protects the installation's gravel airstrip from tidal and storm driven wave action. Over the past decade the runway's seawall has been depleted and eroded by wave action and extreme weather events. The damaged rock reinforcement became ineffective, and the 5,450 linear foot wall had to be replaced at a cost of \$46.8 million.

Waldo Canyon Fire, Peterson AFB and the U.S. Air Force Academy

When wildfires occur, they can be devastating to military installations and local communities, causing loss of life, property damage, destruction of habitat, and severe water quality impacts. In the summer 2012, the Waldo Canyon Fire, one of the most destructive wildfires in Colorado history, consumed over 18,000 acres, threatening Peterson AFB and the U.S. Air Force Academy and costing over \$16 million to battle. Air Force resources including Air National Guard personnel, ground vehicles, and C-130s loaded with Modular Airborne Firefighting Systems (MAFFS), a system



(U.S. Air Force photo)

of pressurized tanks and pumps that can drop 3,000 gallons of water or fire retardant within seconds, were mobilized and diverted from normal operations to support the U.S. Forest Service in combating fires in Colorado and across other states in the region.

THE SLVAS DEVELOPMENT & APPROACH

The DoD maintains over 500 installations across the globe with thousands of associated individual sites that vary in size, configuration, and distance from each other. Given the sheer number of sites in its portfolio and the desire to understand where more comprehensive assessment may be needed, the OASD(EI&E) developed and initiated a preliminary screening level assessment survey of its worldwide sites.

Working with the Military Services, Defense Logistics Agency, and Washington Headquarters Services, as the infrastructure owning/managing components, and using data and unique identifiers from DoD's Real Property Assets Database (RPAD), an on-line survey instrument – housed in a database and accessed through a password-protected web-based interface – was developed by OASD(EI&E).

The survey questions focused on observed effects from past severe weather events (which may be indicative of more frequent and/or more severe future conditions), and the proximity of site acreage to any flood-prone areas. The survey asked for the identification of the negative effects experienced from effects, both on the DoD site assets as well as any observed effects on similar assets in the surrounding community that provided supporting services (e.g., utilities, transportation, emergency response) for the DoD site. These included:

- Flooding due to storm surge
- Flooding due to non-storm surge events (e.g., rain, snow, sleet, ice, river overflow)
- Extreme temperatures (both hot and cold)
- Wind
- Drought
- Wildfire

The asset categories evaluated included:

- | | |
|--|--|
| • Airfield Operations (on and off-site) | • Emergency Services (on and off-site) |
| • Training Areas/Ranges/Facilities (on-site) | • Water/Wastewater Systems (on and off-site) |
| • Piers/Waterfront Services (on and off-site) | • HVAC Systems (on and off-site) |
| • Information Systems (on and off-site) | • Environmental Restoration sites (on-site) |
| • C4ISR (on-site) | • Natural Resources (on-site) |
| • Energy Infrastructure (on and off-site) | • Historic/Cultural Resources (on-site) |
| • Fuel Infrastructure (on and off-site) | • Housing (on and off-site) |
| • Logistics/supply (on and off-site) | • HQ Buildings (on-site) |
| • Transportation Infrastructure & Routes (on and off-site) | • Personnel Support (on-site) |

The survey also allowed personnel to indicate if no assets had ever been affected or if they were unable to determine whether or not assets had been affected, and to describe other assets not included in the above list that had been affected. The SLVAS questionnaire is provided in Appendix 1, the SLVAS website Welcome page text including climate variable definitions is in Appendix 2, and asset category definitions are contained in Appendix 3.

Surveys were released through three phases to ensure that the survey questions and asset categories were relevant and the survey instrument itself was easy to use. A pilot phase with 10 sites took place

November and December 2013, with a second phase, focused on the roughly 500 sites within two kilometers of coastal or tidal areas, starting in March 2014 with a 90-day completion date. The final phase for the remainder of the worldwide sites was initiated in September 2014 with one year for completion. Refinements to the asset categories and the survey instrument were made throughout this process.

The development of the survey questions, topics, and contents is described in the sections below.

Scoping and Assumptions

Process

OASD(EI&E) commenced meetings of a small, dedicated group in mid-2013. There was early recognition within the group that assessments of this type would ideally be integrated into existing plans and processes. A review of the Defense Critical Infrastructure Program efforts under the Joint Mission Assurance Assessment Program helped to scope the screening baseline and also pointed to a potential follow on tool for future assessments.

Three groups of questions emerged:

1. What is the site's current vulnerability? What has happened in the past that may have affected the site?
2. Does the site have the capability to assess future vulnerability? Does it have GIS capability and accurate elevation data?
3. If the site has the ability to assess its future vulnerability, what does the future vulnerability look like?

There was acknowledgement that evaluating effects from past events would be a good starting point as the availability and quality of reliable elevation data and modeling capabilities would vary across installations. The decision was made to proceed without finalized regional sea level projections or extreme water level scenarios and instead to utilize an increasing 3 feet scale of mean sea level rise – *What might be negatively impacted/degraded with an increase of up to 3 feet in mean sea level?*

Additional questions requested the same information for 0-6, 0-9, and 0-12 feet. Estimating through this screening process how many acres are within a flood zone, what land percentage that represents, and what might be affected or degraded with that increase, allows the data to be collected for future use.

Survey question development

Several assumptions were retained throughout the survey development:

- Maintain use of Real Property and Site Unique Identifier (RPSUID) throughout the process so data can be tagged to other databases
- Address severe weather risk management issues
- Keep the question simple – 'yes' or 'no' relative to effects; if 'no,' move to the next section
- Focus on current vulnerabilities
- Include both on-site and off-site effects
- Have a representative set of asset categories to include facilities, infrastructure, operations, and associated services
- Recognize that resultant survey responses will not lead to directly actionable information

- Survey will not include USACE Civil Works sites as they fall under different oversight authorities.

Several refinements and additions were made during survey development and the pilot, including:

- Need to distinguish an ‘installation’ from a ‘site’ (see next section)
- Request historical event information (e.g., flood height, wind speed, etc.)
- Request information about FEMA flood zones on site (e.g., where are FEMA maps of designated areas available)
- Add ‘extreme temperatures’ (suggestion related to concerns about effects on information systems) to list of climate effects and leave out definitions for ‘hot’ or ‘cold’ as there could be different thresholds depending upon location
- Add subcategories of ‘rain,’ ‘ice/sleet,’ ‘snow,’ and ‘river overflow’ to the non-storm surge events category
- Add ‘natural resources’ and ‘historical/cultural resources’ (suggestion from pilot site) to asset category list
- Request information regarding whether survey was a duplicative effort and the level of effort to complete survey
- Request data sources used to complete survey
- Add Command level categorization for easier data filtering

Other topics were discussed and determined best assessed at later stages, such as questions relative to:

- Lost mission days
- Asset criticality level
- Damage cost estimates
- Humidity
- Positive effects
- Human health aspects
- Impact magnitude or severity and vulnerability ratings

Installation versus site distinction

As noted above, DoD maintains over 500 installations worldwide, each composed of one or more sites. In some cases, a site can be under the control of an installation but be located hundreds of miles away; in others, multiple contiguous sites represent one installation. For the purposes of assigning tasks and searching for sites within the database, the sites were nested under the installations (called Primary Installations within SLVAS). Since each site has a unique identifier, an RPSUID, personnel completing the surveys could validate the individual site and associated answers. SLVAS only looked at enduring sites, not contingency bases.

DoD **sites** are defined as the physical (geographic) location that is, or was owned by, leased to, or otherwise possessed by a DoD Component on behalf of the United States. Each *site* (except for leased) is assigned to a single *installation*. A site may exist in one of three forms:

- **Land only**, where no facilities are present and where the land consists of either a single land parcel or two or more contiguous land parcels.

- **Facility or facilities only**, where the underlying land is neither owned nor controlled by the government. A stand-alone facility can be a site. If a facility is not a stand-alone facility, it must be assigned to a site.
- **Land, and all the facilities thereon**, where the land consists of either a single land parcel or two or more contiguous land parcels.

An **installation** is defined as a base, camp, post, station, yard, center, homeport facility for any ship, or other activity under the jurisdiction of the DoD, including any leased facility, which is located within any of the States, the District of Columbia, the Commonwealth of Puerto Rico, American Samoa, the Virgin Islands, the Commonwealth of the Northern Mariana Islands, or Guam. Such term does not include any facility used primarily for civil works, rivers and harbors projects, or flood control projects. In the case of an activity in a foreign country, an installation is any property under the operational control of the Secretary of a Military Department (MILDEP) or the Secretary of Defense, without regard to the duration of operational control. For real property accountability, an *installation* must consist of one or more real property *sites*.

Survey Instrument

Account Set Up

For security and integrity of information, user accounts and access to the database can be completed only after entering a Component specific registration code on the on-line survey webpage and setting up an account. The SLVAS website includes several tabs in addition to the Home page:

- Surveys - the launching page to create and manage site surveys;
- Project Contacts - names and contact information for the SLVAS, by Component;
- My Profile – ability to maintain profile and change password; and
- Resources – help documents, tutorials, and links to the Defense Installation Spatial Data Infrastructure (DISDI) Portal or Component equivalent Portals.

SLVAS Questionnaire

The SLVAS questionnaire (Appendix 1) is divided into three sections. Six sets of questions relate to **Current Vulnerability** (Section 1); one set of questions relates to **the Implications of Increased Mean Sea Level** (Section 2). Three questions relate to **Background Information**. Appendix 2 includes the SLVAS website Welcome page text and the climate variable definitions that should be utilized for completion of Sections 1 and 2.

The Background Information section is the first set of questions. It requests information regarding the vertical datum used for elevation measurements, the percentage of the installation within the 100 and 500 year flood zones as determined by FEMA, and the tools / resources / methodologies used to determine each of these.

Users refer to the asset category definitions in Appendix 3 as they complete Sections 1 and 2. Section 1 is a series of six parallel sets of questions about whether a site has been affected by flooding due to storm surge, flooding due to non-storm surge events (rain, ice/sleet, snow or river overflow), extreme temperatures (hot or cold), drought, wildfire, and wind. Each of these is defined at the beginning of the section. If a site has been affected, then they are asked to identify what type of asset was affected.

Training areas, ranges, and test facilities comprise one of the categories. Finally, the site is asked how they responded to the effects in the short term and if any long term changes were made to prevent/reduce future effects.

Several features were developed to aid survey completion. A user can “transfer” a survey to another user within the same Component for review and/or completion. The “copy” functionality lets a user complete and finalize one site survey and copy the results to additional sites; the user can then modify and finalize those site surveys. The “exempt” feature allows users to exempt a site from survey completion for one of two reasons: 1) the site was not deemed a high priority for screening purposes at this time (often used when sites were close to closure) or 2) the site was covered under a different site; in some cases, one completed survey could represent multiple contiguous sites.

Phased Survey Approach

Surveys were released through three phases to ensure that the survey questions and asset categories were relevant and the survey instrument itself was easy to use. Refinements to the asset categories and the survey instrument were made throughout this process.

Phase 1: 10 Pilot Sites

Ten pilot sites were selected by the Services to validate and provide feedback on the survey content and execution process in November-December 2013. Refinements were made to improve the user experience for Phase 2. The pilot sites are listed by Service below.

- Air Force
 - Keesler AFB
 - Langley AFB
 - Patrick AFB
- Army
 - Aberdeen Proving Ground
 - Fort Lee
 - Newport USARC
 - Oregon ARNG
- Navy
 - CBC Gulfport
 - NAVSUBASE New London
 - NS Mayport

Phase 2: Sites within 2 km of a Coastal/Tidal Zone

On March 7, 2014, the Military Departments were requested via memorandum to complete surveys for those sites deemed to fall within 2 km of a coastal or tidal zone, roughly 500 sites, within 90 days.

Phase 3: Remaining Sites World-Wide

On September 2, 2014, the Military Departments were requested via memorandum to complete surveys for the remainder of primary installations and associated sites worldwide with one year for completion. Washington Headquarters Service and the Defense Logistics Agency were tasked on 17 September.

ANALYSIS, TRENDS AND CONCLUSIONS

The survey responses are maintained in a database accessible to registered users. As described below, Services or Components can sort the responses through a number of different reports to support analyses at different levels and for different purposes.

SLVAS Reports

Those with elevated survey privileges can run reports for their Component in Microsoft Word or Excel. The reports are a combination of content-driven and administrative reports and many are intended to be one mechanism for the Components to determine overarching trends (if any) from the survey responses. The reports range from high-level, narrative-style reports (e.g., High-Level Survey Summary) to multiple-sheet Excel spreadsheets (e.g., Asset Categories vs Vulnerability Areas or Sites vs Vulnerability Areas Reports). All reports can be filtered to show only the desired Components and report elements. A list of available reports follows.

- High-Level Survey Summary
- Statistical Summary Chart with Filter Capability
- Current Vulnerabilities Chart
- Current Vulnerabilities Frequency
- Current Vulnerabilities List
- Asset Categories vs Vulnerability Areas Report
- Sites vs Vulnerability Areas Report
- Survey Completion Status
- Exempt Sites
- User Community
- Site Acreage 0-3 Feet of Mean Sea Level
- Site acreage within FEMA Flood zones
- Final Survey Questions
- No Impacts by Site and Vulnerability Report

Qualitative Results

The SLVAS responses yielded a wide range of qualitative information. The highest number of reported effects resulted from drought (782) followed closely by wind (763) and non-storm surge related flooding (706). About 10% of sites indicated being affected by extreme temperatures (351), while flooding due to storm surge (225) and wildfire (210) affected about 6% of the sites reporting. Nearly 50% of sites (1,684) reported they had no impacts to any assets from the effects. The geographic dispersion of sites reporting effects from one or more effects was very broad and was very similar to those reporting no effects at all. This may have more to do with the nature of a qualitative survey completed by hundreds of different users than it did the actual sites themselves. The following assets reported one or more effects: airfield operations, transportation infrastructure, energy infrastructure, training/range facilities, and water/wastewater systems to round out the top five. Logistics/supply operations ranked last in reported.

POST-SURVEY ANALYSES

The following section provides feedback received from the Army, Navy, Marine Corps and Air Force regarding the results of the survey and future plans.

Army

The SLVAS responses, while anecdotal in nature, indicated a wide variation of reported effects on installation-level assets from flooding, extreme temperatures, wind, drought, and wildfire. Installations can use their SLVAS responses as they prepare future updates of their installation-specific plans and planning processes.

To enable more consistent evaluation of potential effects, the Army is modifying a USACE Civil Works vulnerability assessment tool that includes historic data and projections from authoritative sources. It is contingent that installations will use the tool in conjunction with planning guidance being developed by HQ Army. This will assist installations in: (a) consistently assessing their vulnerabilities for specific functional areas (e.g., natural resources, water supply) and (b) integrating considerations related to those vulnerabilities into their installation-level plans (e.g., real property master plans, water resource management plans, integrated natural resources management plans). Installations will incorporate those considerations in their next scheduled plan updates. By using consistent authoritative datasets and planning guidance, Army Commands will be able to prioritize potential future installation-level actions to meet their respective mission requirements, and HQ Army entities will be able to identify and address potential Army-wide issues.

Navy

Of the 761 Navy sites surveyed in SLVAS, 73% of the sites indicated some sort of effect from past flooding, extreme temperatures, drought, wildfire or wind events. The most prevalent factor was wind events, followed by non-storm surge flooding and flooding due to storm surge.

Of the 292 Navy sites surveyed that are located within 2km of the coastline, 45% of the sites indicated some sort of effect from storm surge and non-storm surge flooding in the past. Navy plans to integrate the information into its planning and assessment processes.

U.S. Marine Corps

Data gathered during the SLVAS survey supported a validation that some U.S. Marine Corps (USMC) sites have experienced impacts from flooding, winds, extreme temperatures, drought, and wildfires. From the SLVAS responses, the impact categories receiving the highest frequency of occurrences are training areas/ranges/facilities and HVAC systems from extreme temperatures. With a slightly reduced number of occurrences, flooding is impacting training areas/ranges/facilities and transportation infrastructure, and wind is impacting housing.

The USMC has provided access to USMC SLVAS results to several USMC communities of interest. The SLVAS responses by USMC installations provide information that may be helpful when conducting more detailed vulnerability assessments. The USMC continues to integrate the SLVAS information and additional available climate resilience considerations into its existing assessment and planning processes to manage risks to mission. The quality of these recurring assessments/plans improves iteratively, as the science and understanding of climate also improves.

Air Force

Although the Air Force (AF) already considers weather, natural hazards and other environmental factors during individual mission and installation planning efforts, SLVAS provided a tool to begin to qualitatively understand vulnerabilities to severe weather in a more holistic fashion. Of the 1,531 AF sites (which includes many geographically-separated assets and not just installations), 60% reported having experienced some effects resulting from past flooding, extreme temperature, drought, wildfire or wind events.

In very few cases did data show effects to be so extreme as to cripple the operational mission of a Base. Examples are:

- *Homestead Air Force Base, FL from Hurricane Andrew (1992) which at the time proved to be the most destructive hurricane in U.S. history.*
- *Langley Air Force Base, VA from Hurricane Isabel (2003) which was the costliest disaster in the history of Virginia.*

The single most prevalent factor was drought which accounted for 42% of all reported effects, followed by non-storm surge flooding and wind at 19% each. For the majority of reported severe weather events, bases reported emergency preparedness actions and procedures were successful in mitigating impacts on mission and personnel. That being said, mitigation becomes more difficult, and cumulative impact to missions more crippling, with increasing frequency and/or magnitude of severe weather events.

SLVAS responses also showed 78 AF sites to be within 2 kilometers of a coast, and a third of these indicated effects due to storm surge flooding. This demographic includes half a dozen major installations as well as numerous mission-critical communications and radar sites that are within 0 to 6 feet of sea level.

The AF continues to update policies and procedures to include consideration for climate resiliency. One example of an updated procedure deals with how the AF plans and develops each base. Similar to local government comprehensive or master plans, AF installation development plans (IDPs) are an integral part of the comprehensive planning process that guide development on AF installations. The concepts and principles of sustainable planning are mandatory elements in the AF comprehensive planning process, and IDPs



have evolved to include Sustainability Development Indicators (SDIs). SDIs and their associated metrics serve to integrate sustainability into the planning process, and can be used as measurement and predictive tools along with other information to inform the planning process and assess the impacts of planning actions. The 18 SDI categories used by the AF address a number of sustainability areas, from energy to water to solid waste to facilities and space optimization. Climate vulnerability has been added to the External Sustainability category. Example climate metrics address factors such as flooding, temperature rise, changing precipitation patterns, water supply stress, droughts, etc. Wherever possible, data collected through SLVAS is being incorporated in these climate metrics.

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

SCREENING LEVEL VULNERABILITY ASSESSMENT SURVEY

- SAMPLE -

*[Type of Answer]***Background Information**

This section requests information regarding what vertical datum is used for elevation measurements and what percentage of your installation is within the 100 and 500 year flood zones as determined by FEMA.

1.a For elevation measurements what vertical datum do you use: e.g., NAVD-88, local benchmark, other? *[TEXT]*

1.b What percentage of your installation falls within the 100 year flood zone as determined by FEMA? *[Choices: %, N/A – this site is not within the US; Unknown]*

Please describe the tools/resources/methodologies used to determine the percentage, or describe why you were not able to determine the percentage.

1.c What percentage of your installation falls within the 500 year flood zone as determined by FEMA? *[Choices: %, N/A – this site is not within the US; Unknown]*

Please describe the tools/resources/methodologies used to determine the percentage, or describe why you were not able to determine the percentage. *[TEXT]*

Section 1: Current Vulnerability – Flooding Due to Storm Surge

This section focuses on the impacts of flooding due to storm surge --- the submersion of normally dry land due to an unusual increase in water level due to a storm, over and above the predicted astronomical tides (ocean or tidally influenced body of water).

1.a Has your installation been negatively impacted by flooding due to storm surge? *[Yes/No]*

1.b When was your installation negatively impacted by flooding due to storm surge?

Please list years/times within ~the past 30 years.

For the worst flooding incident, please list the highest inundation level. *[TEXT]*

1.c For the worst storm surge incident, what was impacted/degraded? *[click checkbox(es)]*

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

1.d How did your installation respond to this degradation in the short-term?

Were any long-term changes made to prevent/reduce future impacts? *[TEXT]*

Section 1: Current Vulnerability – Flooding and Other Impacts due to Non-Storm Surge Events

This section focuses on flooding and other impacts caused by non-storm surge events (e.g., rain, ice/sleet, snow) that may result in adverse impacts, such as flooding due to a large amount or extended duration of heavy precipitation, on-site or upstream events that causes non-tidal river overflow (precipitation or melting), OR other impacts such as collapse of structures due to excessive weight of snow/ice.

1.e Has your installation been negatively impacted by flooding and other impacts caused by non-storm surge events? *[Yes/No]*

If yes, what caused the negative impacts? *[click checkbox(es)]*

Rain

Ice/Sleet

Snow

River overflow

1.f When was your installation negatively impacted by these events?

Please list years/times within ~the past 30 years.

For the worst damage caused by an event, please list any data relative to amount of precipitation (e.g., inches), height of flooding, duration of precipitation, etc. *[TEXT]*

1.g For the worst damage caused by an event, what was impacted/degraded? *[click checkbox(es)]*

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

- 1.h How did your installation respond to this degradation in the short-term?**
Were any long-term changes made to prevent/reduce future impacts? *[TEXT]*

Section 1: Current Vulnerability – Extreme Temperatures (hot or cold)

This section focuses on the impacts of any temperature (hot or cold) that falls outside of the “normal” temperature range for a particular area and can represent sustained periods of abnormally and uncomfortably hot or cold weather that fall outside of the “normal.” Note that the “normal” temperature range, for the purposes of this survey, is up to the discretion of the user, but must be clearly explained in the notes.

- 1.i Has your installation been negatively impacted by extreme hot or cold temperatures?**
[Yes/No]

If yes, choose one or both: *[click checkbox(es)]*

Hot

Cold

- 1.j When was your installation negatively impacted by extreme hot or cold temperatures?**
Please list years/times within ~the past 30 years.
For the worst impact caused by extreme temperature, please list any data relative to daily temperature, maximum or minimum temperature, duration of extreme temperature, etc.
[TEXT]

- 1.k For the worst impact caused by extreme hot temperature, what was impacted/degraded?**
[click checkbox(es)]

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

1.1 For the worst impact caused by extreme cold temperature, what was impacted/degraded?
[click checkbox(es)]

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

1.m How did your installation respond to this degradation in the short-term?

Were any long-term changes made to prevent/reduce future impacts? (Write a brief description below; please distinguish between hot and cold extreme temperatures, if necessary) *[TEXT]*

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

Section 1: Current Vulnerability – Drought

This section focuses on the impacts of a period of abnormally dry weather sufficiently prolonged to cause serious problems such as crop damage or water supply shortages.

1.n Has your installation been negatively impacted by drought? *[Yes/No]*

1.o When was your installation negatively impacted by drought?

Please list years/duration within ~the past 30 years. *[TEXT]*

1.p For the worst drought occurrence, what was impacted/degraded? *[click checkbox(es)]*

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

1.q How did your installation respond to this degradation in the short-term?

Were any long-term changes made to prevent/reduce future impacts? *[TEXT]*

Section 1: Current Vulnerability – Wildfire

This section focuses on the impacts of wildfire - an uncontrolled fire in an area of combustible vegetation that occurs in the wilderness or countryside (although damage is felt by people primarily at the wildland-urban interface, where human structures/developments meet with undeveloped wildland).

1.r Has your installation been negatively impacted by wildfire? *[Yes/No]*

1.s When was your installation negatively impacted by wildfire?

Please list years/duration within ~the past 30 years. *[TEXT]*

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

1.t For the worst wildfire occurrence, what was impacted/degraded? [click checkbox(es)]

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. [TEXT]

1.u How did your installation respond to this degradation in the short-term?

Were any long-term changes made to prevent/reduce future impacts? [TEXT]

Section 1: Current Vulnerability – Wind

This section focuses on the impacts of wind. A wind event, for the purposes of this survey, can be defined as an extended period of sustained high winds, such as during a hurricane, or a single gust event, such as during a thunderstorm.

1.v Has your installation been negatively impacted by wind? [Yes/No]**1.w When was your installation negatively impacted by wind?**

Please list years/duration within ~the past 30 years.

For the worst wind incident, please list the top wind speed that was reached. [TEXT]

1.x For the worst wind incident, what was impacted/degraded? [click checkbox(es)]

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

- 1.y How did your installation respond to this degradation in the short-term?
Were any long-term changes made to prevent/reduce future impacts? *[TEXT]*

Section 2: Implications of Increased Mean Sea Level

This section focuses on the impacts to your installation from increased mean sea level – how many acres of your installation are within particular feet of mean sea level and what might be negatively impacted/degraded with a particular increase in mean sea level?

- 2.a Is any part of your installation within 0-12 feet of mean sea level? *[Yes/No]*

- 2.b How many acres of your installation are within 0 to 3 feet of mean sea level? *[#]*

What percentage of your installation land does that represent? *[#] %*

Please describe the tools/resources/methodologies used to determine the acreage, or describe why you were not able to determine the acreage. *[TEXT]*

- 2.c What might be negatively impacted/degraded with an increase of up to 3 feet in mean sea level? *[click checkbox(es)]*

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

Please describe the resources/tools/methodologies used to determine impacts under this scenario or why you were not able to determine impacts. If your response is the same as above, copy and paste the response into this text box. *[TEXT]*

2.d How many acres of your installation are within 0 to 6 feet of mean sea level? [#]

What percentage of your installation land does that represent? [#] %

Please describe the tools/resources/methodologies used to determine the acreage, or describe why you were not able to determine the acreage. If your response is the same as above, copy and paste the response into this text box. *[TEXT]*

2.e What might be negatively impacted/degraded with an increase of 0 to 6 feet in mean sea level? *[click checkbox(es)]*

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

Please describe the resources/tools/methodologies used to determine impacts under this scenario or why you were not able to determine impacts. If your response is the same as above, copy and paste the response into this text box. *[TEXT]*

2.f How many acres of your installation are within 0 to 9 feet of mean sea level? [#]

What percentage of your installation land does that represent? [#] %

Please describe the tools/resources/methodologies used to determine the acreage, or describe why you were not able to determine the acreage. If your response is the same as above, copy and paste the response into this text box. *[TEXT]*

2.g What might be negatively impacted/degraded with an increase of 0 to 9 feet in mean sea level? *[click checkbox(es)]*

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. *[TEXT]*

Please describe the resources/tools/methodologies used to determine impacts under this scenario or why you were not able to determine impacts. If your response is the same as above, copy and paste the response into this text box. *[TEXT]*

2.h How many acres of your installation are within 0 to 12 feet of mean sea level? [#]

Appendix 1 - Screening Level Vulnerability Assessment Survey (SLVAS) Questionnaire

What percentage of your installation land does that represent? [#] %

Please describe the tools/resources/methodologies used to determine the acreage, or describe why you were not able to determine the acreage. If your response is the same as above, copy and paste the response into this text box. [TEXT]

2.i What might be negatively impacted/degraded with an increase of 0 to 12 feet in mean sea level? [click checkbox(es)]

ON-SITE/DoD Controlled	OFF-SITE/Community Assets
Airfield Operations:	Airport:
Training Areas/Ranges/Facilities:	
Piers/Waterfront Services:	Piers/Waterfront Services:
Information Systems:	Information Systems:
C4ISR:	
Energy Infrastructure:	Energy Infrastructure:
Fuel Infrastructure:	Fuel Infrastructure:
Logistics Supply:	Logistics Supply:
Transportation Infrastructure & Routes:	Transportation Infrastructure & Routes:
Emergency Services:	Emergency Services:
Water/Wastewater Systems:	Water/Wastewater Systems:
HVAC Systems:	HVAC Systems:
Environmental Restoration Sites:	
Natural Resources:	
Historic/Cultural Resources:	
Housing:	Housing:
HQ Building(s):	
Personnel Support:	
No Impacts:	No Impacts:
Not able to determine:	Not able to determine:
Other:	Other:

If you selected Other, please provide a description below. [TEXT]

Please describe the resources/tools/methodologies used to determine impacts under this scenario or why you were not able to determine impacts. If your response is the same as above, copy and paste the response into this text box. [TEXT]

Final Survey Questions

- 1 Does this survey duplicate any efforts? If so, which one(s)? [TEXT]
- 2 What did it take to gather the information and complete the survey? How many...?
Manhours: [#] People: [#] Offices: [#]
- 3 Optionally, please provide any additional comments or feedback. [TEXT]

Appendix 2 - SLVAS Welcome Page text, including climate variable definitions

Welcome to the Screening Level Vulnerability Assessment Survey home page!

The Department of Defense is conducting a screening level vulnerability assessment of all sites owned and operated by the Department. The answers to a series of questions on current and potential vulnerabilities will enable the Services to identify current areas of vulnerability and where additional assessment/actions may be necessary. Six sets of questions relate to **Current Vulnerability** (Section 1); one set of questions relates to **the Implications of Increased Mean Sea Level** (Section 2). Three questions relate to **Background Information**.

Background Information

This section requests information regarding what vertical datum is used for elevation measurements and what percentage of your installation is within the 100 and 500 year flood zones as determined by FEMA.

Section 1 – Current Vulnerability: Flooding due to Storm Surge

This section focuses on the impacts of flooding due to storm surge --- the submersion of normally dry land due to an unusual increase in water level due to a storm, over and above the predicted astronomical tides (ocean or tidally influenced body of water).

Section 1 – Current Vulnerability: Flooding and Other Impacts due to Non-Storm Surge Events

This section focuses on flooding and other impacts caused by non-storm surge events (e.g., rain, ice/sleet, snow) that may result in adverse impacts, such as flooding due to a large amount or extended duration of heavy precipitation, on-site or upstream events that causes non-tidal river overflow (precipitation or melting), OR other impacts such as collapse of structures due to excessive weight of snow/ice.

Section 1 – Current Vulnerability: Extreme Temperatures (hot or cold)

This section focuses on the impacts of any temperature (hot or cold) that falls outside of the “normal” temperature range for a particular area and can represent sustained periods of abnormally and uncomfortably hot or cold weather that fall outside of the “normal.” Note that the “normal” temperature range, for the purposes of this survey, is up to the discretion of the user, but must be clearly explained in the notes.

Section 1 – Current Vulnerability: Drought

This section focuses on the impacts of a period of abnormally dry weather sufficiently prolonged to cause serious problems such as crop damage or water supply shortages.

Section 1 – Current Vulnerability: Wildfire

This section focuses on the impacts of wildfire - an uncontrolled fire in an area of combustible vegetation that occurs in the wilderness or countryside (although damage is felt by people primarily at the wildland-urban interface, where human structures/developments meet with undeveloped wildland).

Section 1 – Current Vulnerability: Wind

This section focuses on the impacts of wind. A wind event, for the purposes of this survey, can be defined as an extended period of sustained high winds, such as during a hurricane, or a single gust event, such as during a thunderstorm.

Section 2 – Implications of Increased Mean Sea level

This section focuses on the impacts to your installation from increased mean sea level – how many acres of your installation are within particular feet of mean sea level and what might be negatively impacted/degraded with a particular increase in mean sea level?

January 2018

Appendix 3 - Asset Category Definitions

Assets Category List Introductory Language.

The list below contains categories of facilities, infrastructure, operations, and associated services that may be impacted by the various situations listed throughout this survey. When considering the “On-Site / DoD Controlled” impacts, please consider the infrastructure and services provided by those areas/buildings/etc. that are within your installation’s control. When considering the “Off-Site / Community Assets” impacts, please consider the infrastructure and services provided by those areas/buildings/etc. that fall outside of your installation’s control, but are within the surrounding community and can serve as a link between outside resources and support and your installation.

Asset Category	Definition
Airfield Operations	An area prepared for the accommodation (including any buildings, installations, and equipment), landing, and takeoff of aircraft.
Training Areas/Ranges/Facilities	Areas and facilities where training activities take place, whether land, sea or air
Piers/Waterfront Services	Pier and/or port complex and associated services that assist and/or provide support to loading, unloading, staging, etc.
Information Systems	Infrastructure, organization, personnel, and components for the collection, processing, storage, transmission, display, dissemination, and disposition of information.
C4ISR	C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) infrastructure (including radar, towers, etc.)
Energy Infrastructure	All aspects of generation, transmission, and distribution systems that are essential to power use at installation (e.g., power lines, substations, generators)
Fuel Infrastructure	All aspects of generation, transmission, and distribution systems that are essential to fuel use at installation, e.g., storage tanks, distribution pipelines, fill stands
Logistics Supply	Storage, inspection, distribution, transport, maintenance (including repair and serviceability), and disposal of materiel as well as the provision of support and services (excluding fuel).
Transportation Infrastructure & Routes	Ground transportation routes and assets; e.g., roads, bridges, and terminals (non-airfield or waterfront).
Emergency Services	Assets and capabilities used to provide the support, resources, program implementation, and services that are most likely to be needed to save lives, protect property and the environment, restore essential services and critical infrastructure, and help victims and communities return to normal, when feasible, following domestic incidents. To include: emergency operations centers, hospitals, clinics.
Water/Wastewater Systems	All aspects of pumping, storage, distribution, collection, and treatment systems that are essential to water use and wastewater management at installation
HVAC Systems	All aspects of HVAC (heating, ventilation, and air conditioning) systems
Environmental Restoration Sites	Sites where actions are required or controls are in place to reduce the risk to human health and the environment from past waste disposal operations and hazardous substance releases.
Natural Resources	“All elements of nature and their environments of soil, sediments, air, and water. Those consist of two general types, as follows: a) earth resources - nonliving resources such as minerals and soil components; and b) biological resources - Living resources such as plants and animals.” [DoDI 4715.03, Natural Resources Conservation Program]
Historic/Cultural Resources	Includes historic properties, cultural items, tribal sacred sites, and archaeological resources/artifacts/collections [see DoDI 4715.16]
Housing	Temporary and/or permanent residential structures, barracks, etc.
HQ Building(s)	Structures where senior installation staff conduct their activities.
Personnel Support	Child care center, school, commissaries, exchanges, etc.
No Impacts	
Not able to determine	
Other	

Sources. Taken or derived from: a) *Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms* (8 November 2010; (as Amended Through 31 January 2011); b) DoDI 4715.03, *Natural Resources Conservation Program*; c) DoDI 4715.16, *Cultural Resources Management*; d) Best professional judgment.

January 2018